

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>5</sup> :

E01F 13/00

A1

(11) International Publication Number:

WO 92/02688

(43) International Publication Date:

20 February 1992 (20.02.92)

(21) International Application Number: PCT/FI91/00238

(22) International Filing Date: 7 August 1991 (07.08.91)

(30) Priority data:

903911

7 August 1990 (07.08.90)

FI

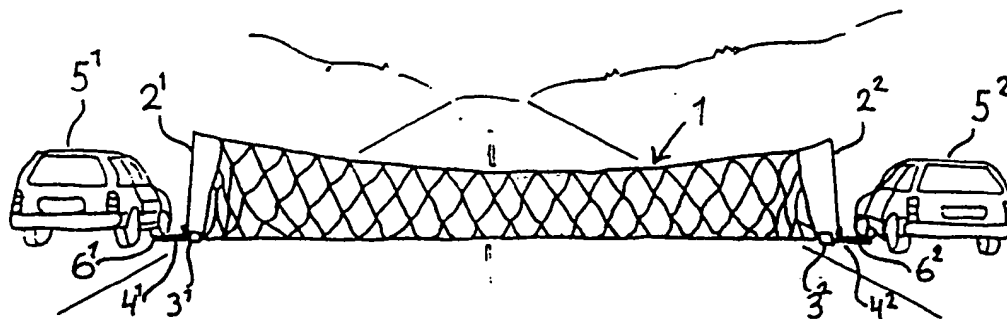
(71)(72) Applicant and Inventor: UOTILA, Jarmo [FI/FI]; PL 130, SF-01801 Klaukkala (FI).

(81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.

Published

*With international search report.  
In English translation (filed in Finnish).*

(54) Title: MEANS FOR SLOWING DOWN AND/OR STOPPING THE MOTION OF A LAND VEHICLE



## (57) Abstract

A means for slowing down and/or stopping the motion of a land vehicle, comprising an elongated net (1) which has been arranged to grab hold of the moving vehicle, a first mast (2<sup>1</sup>) and a second mast (2<sup>2</sup>), which masts have been set to the both ends of the net and have been arranged to keep the net tensioned between the masts, brake members (3<sup>1</sup>, 3<sup>2</sup>), which have been connected between the net and the substantially fixed support points (4<sup>1</sup>, 4<sup>2</sup>) to both ends of the net and which brake members have been arranged to absorb the kinetic energy of the vehicle to be stopped which has been attached into the net, an anchor vehicle (5<sup>1</sup>, 5<sup>2</sup>), which has been arranged to anchor the support points of the brake members. The means comprised of a support body (6<sup>1</sup>, 6<sup>2</sup>), which supports itself to a wheel of the anchor vehicle (5<sup>1</sup>, 5<sup>2</sup>); and a mast (2<sup>1</sup>, 2<sup>2</sup>) and/or the support point (4<sup>1</sup>, 4<sup>2</sup>) of the brake member (3<sup>1</sup>, 3<sup>2</sup>) has been joined to the support body.

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland	KR	Republic of Korea	SN	Senegal
CI	Côte d'Ivoire	LI	Liechtenstein	SU <sup>+</sup>	Soviet Union
CM	Cameroon	LK	Sri Lanka	TD	Chad
CS	Czechoslovakia	LU	Luxembourg	TG	Togo
DE	Germany	MC	Monaco	US	United States of America
DK	Denmark				

<sup>+</sup> It is not yet known for which States of the former Soviet Union any designation of the Soviet Union has effect.

MEANS FOR SLOWING DOWN AND/OR STOPPING THE MOTION OF A  
LAND VEHICLE

The present invention concerns a means as defined  
5 in the preamble to claim 1.

Under some circumstances a moving vehicle must be  
stopped or its motion must be decelerated by external  
means. This kind of a situation can come in question for  
example, when one must stop a vehicle, whose driver, for  
10 example an escaping traffic violator, will not  
voluntarily stop.

It is known in prior art of stopping land  
vehicles by force to use a means, which has been  
described in the applicant's Finnish patent application  
15 FI 892560. This means comprises an elongated net which  
has been arranged to grab hold of the moving vehicle,  
which net comprises a head rope and a foot rope. Also the  
means comprise a pair of masts, which masts have been set  
up at both ends of the net and have been arranged to keep  
20 the net tensioned between the masts. Additionally the  
means comprise brake members, which have been connected  
between the net and the substantially rigid support  
points to both net ends and which brake members have been  
arranged to absorb the kinetic energy of the moving  
25 vehicle. Furthermore the means comprise stationary parked  
anchoring vehicles, which have been arranged to anchor  
stationary the support points of the brake members. In  
the before mentioned publication there has been described  
an embodiment, where the towing hooks of the anchor  
30 vehicles are applied as support points of the brake  
members. Also it is known an embodiment of the means,  
where masts are unconnected tripod-like structures. To  
the bottom part of the mast has been arranged support  
legs, which are spread on the ground surface in such a  
35 way, that they give support to the vertical mast in order  
to hang the net to the mast.

The problem in this prior known means is, that a

towing hook is required in the anchor vehicle in order to attach the brake members. A towing hook or a towing loop is however not in certain countries a standard accessory of a police car, so the anchor vehicles do not always  
5 provide proper attachment points for brake members.

Furthermore the known mast constructions for hanging up the net are unpractical and clumsy with their long support legs. The unconnected masts may fly uncontrolled and harm the persons or the vehicles in the  
10 surrounding during the arresting. The masts may also get attached to the net and get pressed against the body of the arrested vehicle thus causing damages to it. An additional problem is, that the masts may get damaged in the above mentioned situations.

15 The object of the invention is to eliminate the drawbacks mentioned above.

Especially the object of the invention is to present a means for stopping a land vehicle, which is fast to deploy for use and which is suitable for use also  
20 with such anchor vehicles, with are not supplied with towing loop or such ready attachment points.

The object of the invention is additionally to present a means, where both the mast and the brake members can be supported with the aid of the anchor  
25 vehicle.

Furthermore, the object of the invention is to present a means, which is completely safe for the persons both in the vehicle to be stopped and in the surrounding of the arresting site.

30 Furthermore, the object of the invention is to present a means, which does not harm the anchor vehicle or the vehicle to be stopped.

Additionally, the object of the invention is to present a means, which enables a complete "surprise  
35 attack" towards the vehicle to be stopped, ie. an arrest without any advance warning.

In order to accomplish this, the means of the

invention for slowing down and/or stopping the motion of a land vehicle is characterized by that which has been stated in claim 1.

According to the invention, the means comprise a support body, which supports to a wheel of the anchor vehicle; and a mast and/or the support point of the brake member has been joined to the support body. The anchor vehicle keeps with the aid of its mass and the friction between the ground surface and its wheels the support body substantially stationary thus providing an attachment for the mast and/or the brake members. It is possible to support only the mast to the support body, if the anchor vehicle has some other suitable attachment point, e.g. a towing hook for the brake members. The support body can be constructed only for supporting of the mast, in which case the structure can be made very lightweight. If the anchor vehicle has not a suitable attachment point for brake members, one can also attach the brake members to the support body, in which case naturally the support body construction becomes heavier.

In an embodiment of the means, the masts have been arranged to pivot upon the support body between the substantially horizontal downlaying position and the substantially vertical upraised position; that into the system belong a force member to turn the mast between the downlaying and the upraised position, and a locking device to lock the mast to the downlaying and/or the upraised position. This enables a complete "surprise attack" towards the vehicle to be stopped, ie. an arrest without any advance warning, when the net with the masts is raised fast up by the force member only when the vehicle to be stopped is very near the net.

In an embodiment of the means, the support body has been supported to a rear wheel of the anchor vehicle. Supporting to the rear wheel is advantageous, because in this case the wheel and the mast with the support body can not turn to some unwanted direction during the

arresting. Of course, it is possible to support the body member to the front wheel of the anchor vehicle, but this arrangement presumes, that the steering wheel lock is activated and that the position of the locked steering wheel represents direct driving, ie. the front wheels are not turned.

In an embodiment of the means, the support body has been supported to the anchor vehicle at least at two different points.

10 In an embodiment of the means, the support body includes a crib which is open in the middle, which crib is adjusted to surround the anchor vehicle wheel, which has been driven over it and is in contact with the ground surface, which crib is adjusted to support to this wheel  
15 so, that the wheel presses the crib against the ground.

In an embodiment of the means, the support body includes a base part, to which the mast has been attached in a separable way.

In an embodiment of the means, the base part has  
20 been made to pivot upon the support body.

In an embodiment of the means, the force member is a spring, which has been arranged to affect between the base part and the support body, and the locking device has been arranged to releasably lock the base part  
25 in the down position, to which it has been turned against the spring force of the spring.

In an embodiment of the means, the support body includes grab handles, which have been arranged to support to the wheel periphery surface and sides at least  
30 at three different points; and that intermediate distance between the grab handles is adjustable and can be fixed in order to adjust the attachment for different sizes of the wheels.

In an embodiment of the means, the attachment  
35 point of the brake member locates substantially at the level of the wheel center; and that the mast has been arranged to pivot upon a swivel, which locates within a

distance from the attachment point and above it. When the pull force will be set to affect on the support body about at the level of the wheel center, the pull force will not tend to twist the grab handles loose from the wheel. When the pivoting point of the mast locates above the mentioned attachment point, the mast can not get mixed in with the opening process of the brake member. When assembling the means ready for arresting operation, there remains a proper space for the fabric brake members below the attachment point of the brake member and aside the support body.

In an embodiment of the means the force member comprises a pull member, like a rod or a cable, to pull the mast up from its downlaying position and a gas generator fitted with an explosive charge in order to generate the pull into the pull member. The gas generator can be of some known type, e.g. such which are used to tension safety belts in passenger cars.

In an embodiment of the means the support body has been arranged to support to the wheels of the anchor vehicle. The support body can be supported e.g. to both wheels of the rear axle or to the same side wheels of the front and rear axles.

It is an advantage of the invention, that the means can be fast deployed ready for operation and that the means suits for operation with such anchor vehicles, which are not supplied with towing hooks or such ready attachment points.

Furthermore it is an advantage of the invention, that both the mast and the brake members can be supported to the anchor vehicle.

In addition, thanks to the invention, the means is completely safe for the persons both in the vehicle to be stopped and in the surrounding of the arresting site, because the masts are securely attached to the support body.

Furthermore it is an advantage of the invention,

that the means does not harm the anchor vehicle or the vehicle to be stopped.

In the following the invention is described in detail, referring to the attached drawing, wherein:-

5 Fig. 1 presents schematically in side view an embodiment of the means of the invention, and

Fig. 2 shows, viewed inclined from rear, a support body of a second embodiment of the means of the invention,

10 Figs 3. and 4. present schematically in top view support bodies of a third and a fourth embodiment of the means of the invention,

Fig. 5 presents schematically in side view a support body of a fifth embodiment of the means of the  
15 invention,

Fig. 6 presents schematically in side view a support body of a sixth embodiment of the means of the invention, and

Fig. 7 shows of the support body of Fig. 6 in top  
20 view.

In Fig. 1 is depicted a means for stopping the motion of a passenger car, while an elongated net 1 is assembled across the drive way. The means include thus the net 1, whose purpose is to grab hold of the moving  
25 vehicle. Furthermore, the means comprise a first mast 2<sup>1</sup> and a second mast 2<sup>2</sup>, which masts have been set up at both ends of the net and have been arranged to keep the net tensioned between the masts. Additionally, the means comprise brake members 3<sup>1</sup> and 3<sup>2</sup>, which have been  
30 connected between the net and the substantially fixed support points 4<sup>1</sup> and 4<sup>2</sup> to both net ends. The brake members 3<sup>1</sup> and 3<sup>2</sup> have been arranged to absorb the kinetic energy of the moving vehicle, Advantageously the brake members 3<sup>1</sup> and 3<sup>2</sup> are of fabric brake type, where  
35 the absorption of the kinetic energy has been arranged to result from the tearing apart of the interwoven or intersewn textile ribbons, thus absorbing the kinetic



energy in breaking of the intermediate bindings of the ribbons. Additionally the means comprise anchor vehicles 5<sup>1</sup> and 5<sup>2</sup>, which have been arranged to anchor the attachment points 4<sup>1</sup> and 4<sup>2</sup> of the brake members 3<sup>1</sup> and 3<sup>2</sup> substantially stationary with the aid of the vehicles' mass and the friction between the cars and the ground surface. According to the invention, the means include support bodies 6<sup>1</sup> and 6<sup>2</sup>, which support in this embodiment to the wheels of the anchor vehicles 5<sup>1</sup> and 5<sup>2</sup>. The attachment points 4<sup>1</sup> and 4<sup>2</sup> for the brake members 3<sup>1</sup> and 3<sup>2</sup> and the masts 2<sup>1</sup> and 2<sup>2</sup> have been joined to the support bodies 6<sup>1</sup> and 6<sup>2</sup> respectively.

In Fig. 2 is depicted, arranged for a surprise attack, a support body 6<sup>2</sup>, upon which the mast 2<sup>2</sup> has been pivoted between the substantially horizontal downlaying position A and the substantially vertical upraised position Y. In the downlaying position A the net (not shown) lays on the ground surface. Furthermore the means comprise a force member 7 for turning the mast between the downlaying and the upraised position, and a locking device 8 to lock the mast in the downlaying and/or upraised position. When the locking device 8 is released, the mast 2<sup>2</sup> springs up due to the pretensioned spring 7 and thus lifts up the net 1 (not shown) to its upraised position. The masts at bot net ends have been pivoted to turn in the same direction in the support body which direction is substantially perpendicular to the net plane, thus the tension in the net does not change during its turn.

The support body 6<sup>2</sup> includes a crib 9 which is open in the middle, which crib is adjusted to surround the wheel (shown schematically in the Fig. with the dotted line) of the anchor vehicle which has been driven over it and is in contact with the ground surface, which crib is adjusted to support to this wheel so, that the wheel presses the crib 9 against the ground. The support body 6<sup>2</sup> supports to the wheel both from its front and

rear and from its sides. The support body 6<sup>2</sup> in this embodiment has been made of square profile material. The pair of transverse profiles 14 and 15, which pair is in touch with the wheel of the anchor vehicle, locate in a suitable e.g. 30 cm distance from each other, when the wheel is in touch mainly with the ground surface, but presses also the profiles 14 and 15 against the ground. To the transverse profiles 14 and 15 has been fixed a first pair of longitudinal profiles 16 and 17, which pair makes up the crib 9 with the pair of transverse profiles 14 and 15. The first pair of longitudinal profiles 16 and 17 support to the sides of the wheel and prevents the turn of the support body. To a distance from the first pair of longitudinal profiles 16 and 17 is fixed into the transverse profiles 14 and 15 a second pair of longitudinal profiles 18 and 19, to which pair support the bearings 20 and 21. The support body 6<sup>2</sup> includes the base part 10, to which the mast 2<sup>2</sup> has been attached in a separable way. The base part 10 has been made with bearing 20 and 21 to pivot upon the support body 6<sup>2</sup>. The spring 7 has been arranged to affect between the base part 10 and the support body 6<sup>2</sup>. The locking device 8 has been arranged to releasably lock the base part 10 in the down position, to which it has been turned against the spring force of the spring.

Above has been described the support body 6<sup>2</sup> at one end of the net. The support body 6<sup>1</sup> at the opposite end of the net can be principally principally similar to and e.g. a mirror image of the support body in Fig. 2.

In Fig. 6 the support body 6 comprises two transverse bars 22 and 23, perpendicular to the anchor vehicle 5, which bars have been supported to both rear wheels of the anchor vehicle from front and back sides in a similar way as in Fig. 2.

In Fig. 4 the support body 6 is in principle similar to the embodiment in Fig. 2 and which has been supported to the rear wheel of the anchor vehicle.

Additionally the support body comprises parallel to the anchor vehicle a longitudinal bar 24, which is supported also to the front wheel of the anchor vehicle.

In Fig. 5 is shown a special embodiment of the invention, where the force member 7 comprises a pull member 11, like a rod or a cable, to pull the mast up from its downlaying position and a gas generator 13 fitted with an explosive charge 12 in order to generate the pull into the pull member. The explosive charge 12 of the gas generator 13 can be easily ignited with an electrical signal. The gas generator is suitably of some known type, which are commonly used as tension devices for safety belts of cars, and which get activated automatically in accidents. A lightweight gas generator can provide a strong pull force.

In Figs 6 and 7 is shown an embodiment of the support body 6, where the support body 6 comprises grab handles 25, 26, which have been arranged to support to the periphery of the wheel of the anchor vehicle at four points. The intermediate distance between the grab handles 25 and 26 is adjustable and it can be fixed with the fixing members 34 and 35 to fit the attachment of the support body 6 to different size wheels. The adjustment has been arranged with a pliers-guide mechanism. The grab handles 25 and 26 comprise vertical guides 27 and 28, relative to which a first slide member 29 and a second slide member 30 have been arranged to move and to be fixed. The support body 6 includes the first pliers member 31 and the second pliers member 32, which have been swiveled like scissors, able to turn around each other approximately at the center of the wheel. The first pliers member 31 has been swiveled from its other end with the bottom end of the vertical guide 27 of the grab handles 25 and from its other end with the second slide member 30. Respectively, the second pliers member 32 has been swiveled from its other end with the bottom end of the vertical guide 28 and from its other end with the

first slide member 29. When the pliers members 31 and 32 are moved like scissors, the grab handles 25 and 26 move horizontally relative to each other, and the support body 6 can be attached to different size wheels. The base part 10 has been swiveled with the first pliers member 31. The force member 7 affects between the base part 10 and the pliers member 31. The attachment point 4 of the brake member locates at the level of the wheel center, joined with the swivel of the pliers members. The mast 2 has been arranged to turn around the joint 33. The joint 33 has been set at a distance from the attachment point 4, above it. Now the operation of different components do not disturb each other, e.g. the mast 2 does not disturb the opening process of the fabric brake member. Additionally under the attachment point aside the support body remains a space, where the fabric brake can be assembled.

Even though above has been described a means to stop a land vehicle, where the anchor vehicles have been set at both ends of the net, a support body according to the invention can be used also without an anchor vehicle, if such is not available for use. The support body can be supported e.g. to the road side railing. The support body according to Fig. 2 can be pressed e.g. with a hydraulic jack against the ground surface in such a way, that the upper end of the jack supports to the railing and the bottom end to the support body. The embodiment in Fig. 6 can be constructed such, that it can be attached to a railing or a road side tree or a post without any extra accessories.

The invention is not confined exclusively to concern the embodiment examples presented in the foregoing: numerous modifications are feasible while keeping within scope of the inventive idea defined by the claims.

## CLAIMS

1. A means for slowing down and/or stopping the motion of a land vehicle, comprising an elongated net (1) which has been arranged for grabbing the moving  
5 vehicle, a first mast (2<sup>1</sup>) and a second mast (2<sup>2</sup>), which masts have been set up at both ends of the net and have been arranged for keeping the net tensioned between the masts, brake members (3<sup>1</sup>, 3<sup>2</sup>), which have been connected between the net and the substantially fixed support  
10 points (4<sup>1</sup>, 4<sup>2</sup>) to both net ends and which brake members have been arranged for absorbing kinetic energy of the vehicle to be stopped, anchoring vehicle (5<sup>1</sup>, 5<sup>2</sup>), which has been arranged to anchor the attachment points of the brake members, characterised in that the means comprise  
15 of a support body (6<sup>1</sup>, 6<sup>2</sup>), which supports to a wheel of the anchor vehicle (5<sup>1</sup>, 5<sup>2</sup>); and that the mast (2<sup>1</sup>, 2<sup>2</sup>) and/or the support point (4<sup>1</sup>, 4<sup>2</sup>) of the brake member (3<sup>1</sup>, 3<sup>2</sup>) has been joined to the support body.

2. Means according to claim 1, characterised in  
20 that the mast (2<sup>1</sup>, 2<sup>2</sup>) has been arranged to pivot around the support body (6<sup>1</sup>, 6<sup>2</sup>) between the substantially horizontal downlaying position and the substantially vertical upraised position; and that the means comprise a force member (7) for turning the mast between the  
25 downlaying and the upraised position, and a locking device (8) to lock the mast in the downlaying and/or upraised position.

3. Means according to claim 2, characterized in that the support body (6<sup>1</sup>, 6<sup>2</sup>) has been arranged to  
30 support to the rear wheel of the anchor vehicle (5<sup>1</sup>, 5<sup>2</sup>).

4. Means according to any one of the claims 1-3, characterized in that the support body (6<sup>1</sup>, 6<sup>2</sup>) supports to a wheel of the anchor vehicle (5<sup>1</sup>, 5<sup>2</sup>) at least at two points.

35 5. Means according to any one of the claims 1-4, characterized in that the support body (6<sup>1</sup>, 6<sup>2</sup>) includes a crib (9) which is open in the middle, which crib is

adjusted to surround the wheel of the anchor vehicle (5<sup>1</sup>, 5<sup>2</sup>) which has been driven over it and is in contact with the ground surface, which crib is adjusted to support to this wheel so, that the wheel presses the crib against the ground.

6. Means according to any one of the claims 1-5, characterized in that the support body (6<sup>1</sup>, 6<sup>2</sup>) comprises a base part (10), to which the mast (2<sup>1</sup>, 2<sup>2</sup>) is attached in a separable way.

7. Means according to claim 6, characterized in that base part (10) has been arranged to pivot around the support body (6<sup>1</sup>, 6<sup>2</sup>).

8. Means according to claim 7, characterized in that the force member (7) is a spring, which has been arranged to affect between the base part (10) and the support body (6<sup>1</sup>, 6<sup>2</sup>), and that the locking device (8) has been arranged to releasably lock the base part in the down position, to which it has been turned against the spring force of the spring.

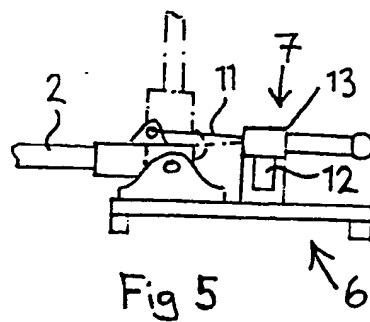
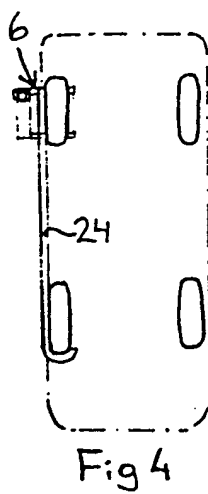
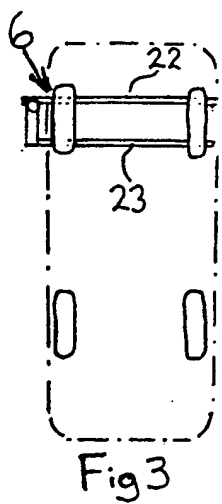
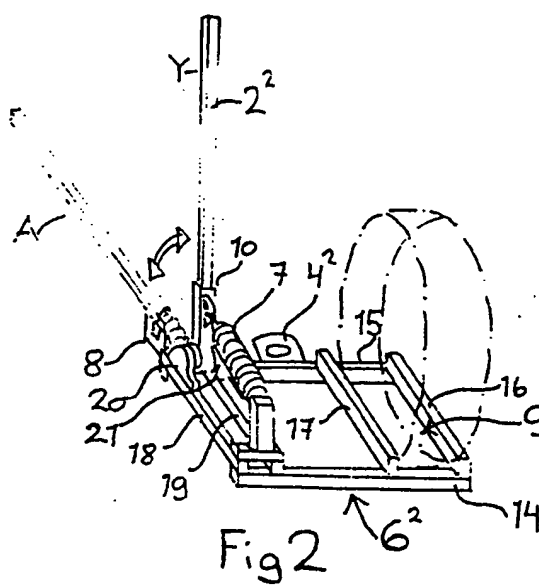
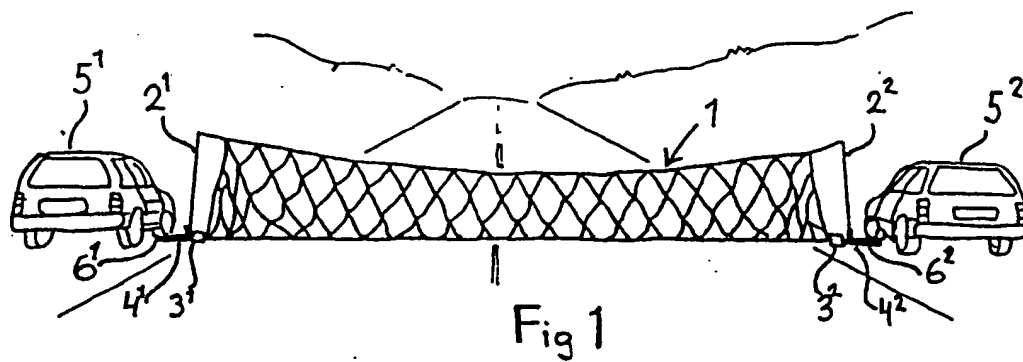
9. Means according to any one of the claims 1-5 or 6-8, characterized in that the support body (6<sup>1</sup>, 6<sup>2</sup>) comprises grab handles (25, 26), which have been arranged to support to the periphery and to the sides of the wheel of the anchor vehicle at least at three different points; and that the intermediate distance between the grab handles is adjustable and it can be fixed to fit the attachment of the support body to different size wheels.

10. Means according to any one of the claims 1-9, characterized in that the support point (4<sup>1</sup>, 4<sup>2</sup>) of the brake member (3<sup>1</sup>, 3<sup>2</sup>) locates at the level of the wheel center; and that the mast (2<sup>1</sup>, 2<sup>2</sup>) has been arranged to turn around the joint (26), which joint has been set at a distance from the attachment point, above it.

11. Means according to any one of the claims 2-6, characterised in that the force member (7) comprises a pull member (11), like a rod or a cable, to pull the mast up from the down laying position and a gas generator (13)

which operates by explosive charge (12) in order to generate pull into the pull member.

12. Means according to any one of the claims 2-11, characterised in that the support body (6<sup>1</sup>, 6<sup>2</sup>) has  
5 been arranged to support to two wheels of the anchor vehicle (5<sup>1</sup>, 5<sup>2</sup>).





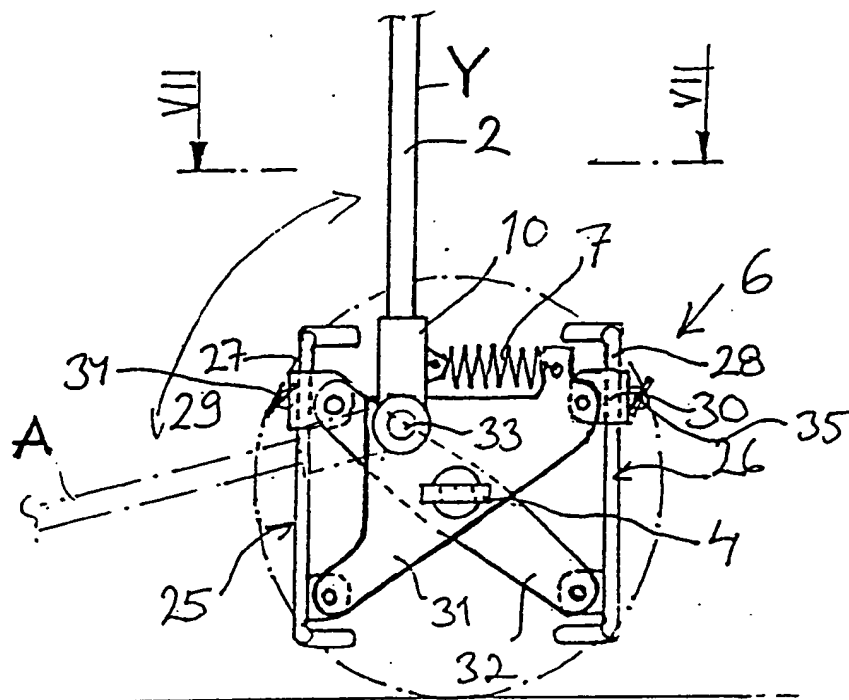


Fig 6

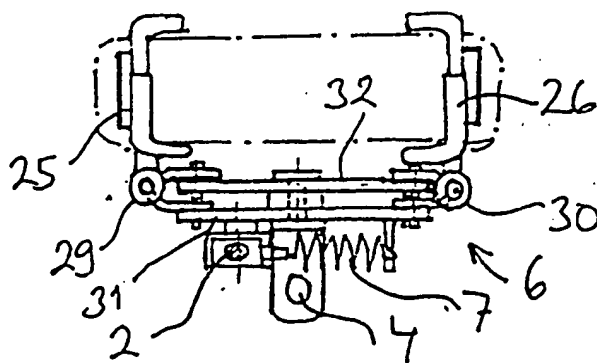
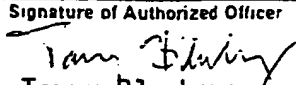


Fig 7

# INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 91/00238

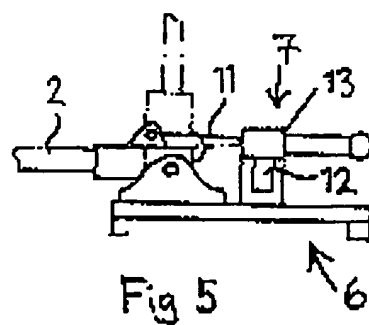
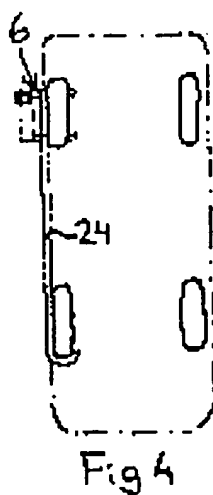
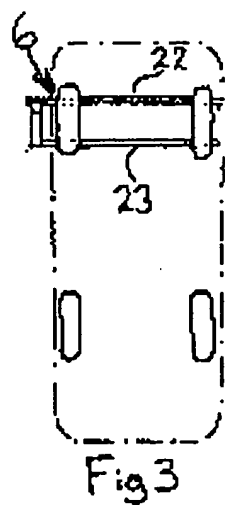
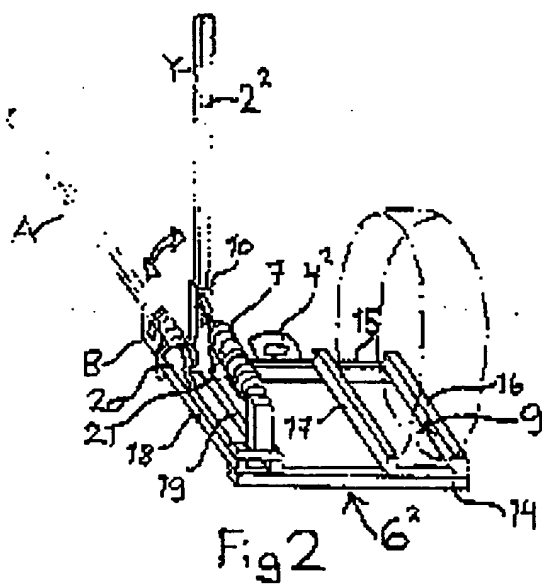
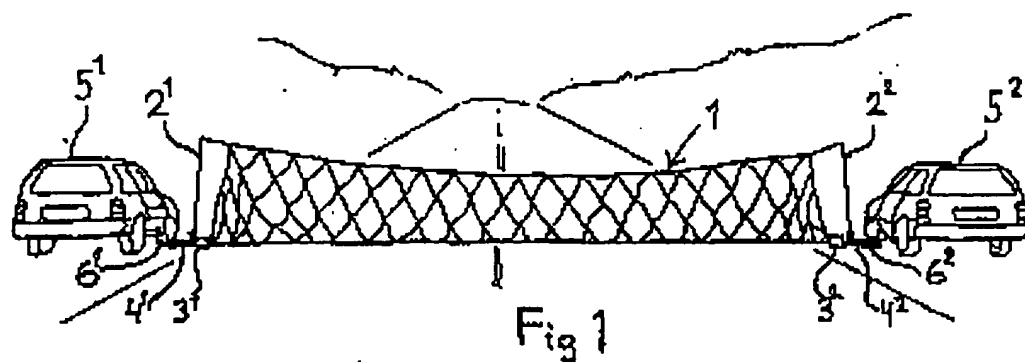
<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC <b>IPC5: E 01 F 13/00</b>		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
IPC5	E 01 F; B 64 F; B 60 T	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched <sup>8</sup>		
SE,DK,FI,NO classes as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category <sup>*</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	WO, A1, 9005809 (UOTILA, JARMO) 31 May 1990, see page 20; claim 6 --	1
A	US, A, 4124196 (HIPSKIND) 7 November 1978, see column 3, line 36 - line 48; column 5, line 28 - line 35 -- -----	1
<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p><b>* Special categories of cited documents:<sup>10</sup></b></p> <p><b>"A"</b> document defining the general state of the art which is not considered to be of particular relevance</p> <p><b>"E"</b> earlier document but published on or after the international filing date</p> <p><b>"L"</b> document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p><b>"O"</b> document referring to an oral disclosure, use, exhibition or other means</p> <p><b>"P"</b> document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 48%;"> <p><b>"T"</b> later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p><b>"X"</b> document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p><b>"Y"</b> document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p><b>"&amp;"</b> document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
12th November 1991		1991 -11- 13
International Searching Authority		Signature of Authorized Officer
SWEDISH PATENT OFFICE		 Tommy Blomberg

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 91/00238**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
The members are as contained in the Swedish Patent Office EDP file on **91-09-27**  
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 9005809	90-05-31	AU-D- 4620989	90-06-12
US-A- 4124196	78-11-07	NONE	

**THIS PAGE BLANK (USPTO)**



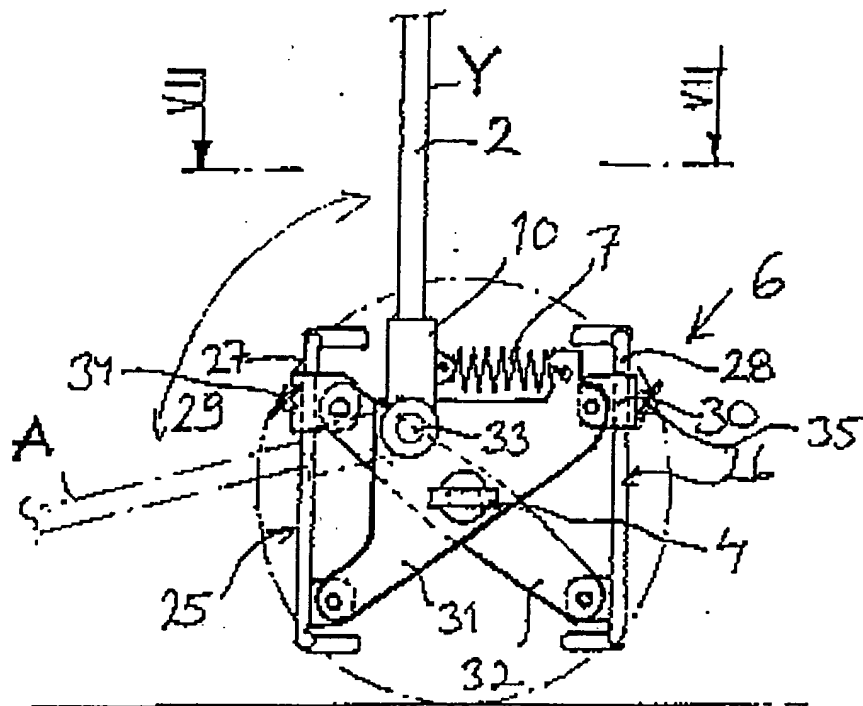


Fig 6

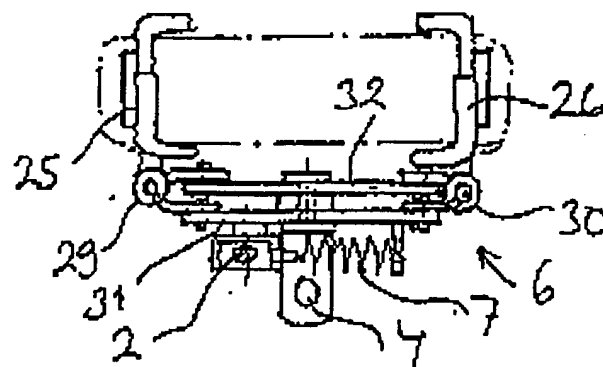


Fig 7